

## BROMOIL TRANSFER PROCEDURE U.S. COAST AND GEODETIC SURVEY

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In compiling nautical charts it is necessary to bring all source material to the scale of the compilation. Various methods for accomplishing this are in use at the U.S. Coast and Geodetic Survey. These include the use of squares, proportional dividers, pantographs, vertical projectors, press plate reverse prints on tracing paper or transparent plastic, photographic film positives, and the recently-developed bromoil technique. Each method has its advantages and disadvantages, depending upon the compilation medium used, the complexity of the source material, and numerous other conditions which must be evaluated by the cartographic engineer before beginning the compilation.

The purpose of this paper is to describe bromoils and their use for transferring copy, as recently developed in the U.S. Coast and Geodetic Survey. As used in this Bureau, a bromoil is a sheet of transparent acetate film containing a tanned gelatin image. This bromoil has the same appearance as a regular photographic film positive, with the exception that its image is buff and that of the film positive, black. Another, and more important difference is that the bromoil's image is ink receptive, while that of the film positive is not. This latter difference, plus the facts that the bromoil's image is extremely hard and abrasive-resistant, and its background is a glossy surface from which ink can be easily washed, are the basic reasons for the success of the transfer procedure now being used in the Coast and Geodetic Survey. In general, this procedure consists of cleaning the entire surface of the bromoil with turpentine, drying, coating with a special ink, washing with water, and then drying again. Each step will be described in detail later in this article. The result is a film positive bromoil from which a clear-cut inked image can be transferred to another medium by burnishing.

Bromoils are not new. Since the early days of photography an attempt has been made to transfer images from one medium to another by « rolling up » ink on film positives, hoping that the ink would adhere only to the emulsified lines which then could be transferred by burnishing.

For the past several years, the U.S. Coast and Geodetic Survey has been using bromoils with some degree of success in conjunction with engraving revisions on glass negatives. This type of bromoil was treated with a grease-base press ink, then dusted with a colored powder and burnished onto a glass negative, for engraving. A bromoil treated in this manner was not suitable for use on vinylite or bristol board, since the resulting image would smear and the drafting inks would not adhere to the grease-powdered transferred image.

Within the past year, however, a method has been developed in this Bureau which is producing excellent results, especially in conjunction with the compilation of nautical charts. The present annual savings of thousands of dollars attributable to this new bromoil procedure are steadily increasing as new uses are discovered.

Although the following description primarily concerns the use of bromoils in connection with compiling nautical charts, the basic procedure is identical for all bromoil uses, some of which are: the compilation of other types of charts and maps, the addition of shoreline to hydrographic field sheets, and engraving on glass or vinylite negatives.

The bromoil method of transfer is most efficient when the chart compilation is to be on an opaque medium and the complexity of the source material warrants the expense of photography. Basically, the Coast and Geodetic Survey's current method for the preparation of bromoils is as follows:

The procedure begins in the darkroom with an unexposed Kodalith film, or any other kind of high contrasting photographic film. Obtained commercially, this is a sheet of acetate coated on both sides with gelatin and then coated on one side with silver. First, the film is removed from its package and placed directly in a plain hypo bath to remove the silver. After all of the silver has been removed the film is washed *thoroughly* and then dried. This leaves an acetate sheet which is gelatin coated on both sides. Emphasis is placed on the washing operation being thorough since any trace of hypo remaining in the emulsion might interfere with subsequent operations.

After the film is dry it is placed on a table top. Both sides are identical at this step. The edges are now taped so that the film lies flat.

Next, using a mixture composed of one part saturated solution of potassium bichromate to three parts water, the film is sensitized by swabbing the mixture across its surface in both directions until the film is saturated.

Following this, the surplus sensitizer is wiped from the surface of the film and the electric fan is turned on to hasten drying. This operation is carried out in subdued or safe light.

When dry, the film bromoil is placed in contact with the film negative previously made to compilation scale by photographing the source material. Both the bromoil and negative are now exposed approximately three minutes with two double arc lamps at a distance of four feet.

After this exposure, the bromoil is developed by placing under a tap and letting water run freely over its surface. Cold water is adequate. The film will develop completely in less than two minutes. After development, the film is removed and dried by wiping the surplus water from its surface and then placing it in front of an electric fan.

The bromoil is now ready for application of the ink, which may be done at any time. The ink currently used is a special thin ink used in brush pens, sold under the trade name « Dri-rite. » When applying the ink to the bromoil's surface, a certain manual deftness or knack is required, which comes only with practice. Excellent results are being attained in the Coast and Geodetic Survey by the following ink-application technique, which can be varied in accordance with individual preference.

#### *Material Required*

**DRI-RITE INK** Available in blue, black, red, brown, purple, green, and yellow.  
Sold in 2-ounce (most convenient) and larger-size bottles by the :

Lockwood Company  
336 Boston Post Road  
Milford, Connecticut

TURPENTINE  
RUBBER GLOVES  
TAPE  
CHEESE CLOTH  
RAW COTTON  
WATER  
BOWL (for water)

### *Directions for Inking*

Rubber gloves should be worn throughout the following inking procedure :

1. Upon receipt of a new bromoil, before coating with ink, both sides of the film are cleaned by rubbing with turpentine on clean pieces of cheese cloth; then dried with a fan. This step insures a clean image side with excellent ink receptivity. The cleaning of the under side facilitates the movement of the burnisher or stylus when transferring the image.

2. The bromoil, with emulsion side up, is placed on a table.

3. Its edges are taped to the table, so that the film lies flat.

4. Ink is applied lightly and evenly over its entire surface by using a small amount of ink on a clean ball of a cotton. Excellent results are obtained by using long sweeping strokes, being careful not to go over any area more than once. Going over the same area will produce a darker transfer, which is especially objectionable when a non-photographic blue image is required.

5. Next, the bromoil is allowed to set for a few minutes until the ink becomes just dry enough so as not to come off on one's finger. The exact time is determined only by experience. If the ink has dried too much, it will not wash off as required in the next step. (If this should happen, the entire bromoil is cleaned with turpentine and re-inked.)

6. Using a ball of cotton, water, and a light brisk sweeping motion, the excessive ink is gradually removed. The operation is repeated, using clean cotton and water, until all of the ink has been removed from the background and only a clear-cut image remains on the bromoil.

7. The bromoil is now dried with cheese cloth using a patting motion and being careful to avoid smearing the inked image. With experience this patting step can also be used to improve the image; using clean cheese cloth to lighten a dark area, and then using this same cloth (now containing a small amount of ink) to improve a weak area.

7a. As a substitute for step No. 7, the bromoil may be dried by hanging in a vertical position and using an electric fan. The drying time for this method is approximately 25 minutes, compared to 5 minutes using the cheese cloth. However, the air drying eliminates any danger of smearing the inked image. The bromoil is now ready for use. In order to compensate for distortion, the bromoil

is adjusted and burnished minute-by-minute on the base projection. A burnisher or dull stylus is used. Five or six usable images can be burnished from a bromoil without re-inking. A bromoil can be re-inked as many as 30 times. The transferring qualities of one treatment lasts for over five weeks. A bromoil can be cleaned and re-treated at any time. Its color can be changed by cleaning and re-treating with ink of another color. For nautical chart transfers, a non-photographic blue ink is used. The resulting blue line on the compilation is non-photographic, smear-proof, and requires no treating or erasing prior to drafting. India ink, and special inks for plastics, draft equally well over this blue line. The distortion of a bromoil is no greater than ordinary film. A bromoil can be printed in reverse or direct, merely by reversing the film negative at the time of contacting.

Summarizing, this bromoil transfer procedure just described has proved so satisfactory in the U.S. Coast and Geodetic Survey that it has replaced the former and more expensive method of preparing reverse prints from press plates. However, even with this success one should realize that the method has not reached perfection and a constant alert for improvements is maintained. For example, experiments are now under way to economically coat both sides of a sheet of acetate with gelatin of a quality similar to that obtained by using hypo to wash away the silver on Kodolith film, and then using water to wash away the hypo. To date, washing the Kodolith film is considered the more efficient process.

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